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ABSTRACT

Educational expenditures in 18 Organisation for Economic Cooperation and Development (OECD) countries for the years 1975 and 1985 are investigated in this report. Data collection is based on analysis of UNESCO's 1989 "Statistical Yearbook" and OECD data. Although data deficiencies allow only a broad assessment, a conclusion is that expenditure per student correlates strongly and positively with GDP (income) per capita. However, an estimate of an expenditure per student function and comparison of "predicted" value with actual observation is recommended as a more appropriate measurement. Finally, the data do not support the view that either substantial under- or over-spending exists in public educational outlays in the United States. Two lessons from the study are: (1) data should be handled with great caution; and (2) there is a need to focus on modeling of public educational expenditures in order to compare observed outlays with fair approximations of desirable levels. Five tables and 28 footnotes are included. The appendices contain data sources, observations on table 1 (a computation of the educational expenditure/GNP ratio), and a comparison of models of K-12 expenditures per student. (16 references) (LMI)

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PUBLIC EDUCATIONAL EXPENDITURES IN INDUSTRIALIZED COUNTRIES: AN ANALYTICAL COMPARISON

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PUBLIC EDUCATIONAL EXPENDITURES IN INDUSTRIALIZED COUNTRIES:
AN ANALYTICAL COMPARISON

Abstract

In view of the recent controversy on the subject, a further careful investigation is undertaken of educational expenditures in 18 OECD countries for the years 1975 and 1985. Ten points are noted. First, data deficiencies make any fine comparisons hazardous, and only a broad assessment can be made reasonably. Second, in terms of public expenditures at all levels as a ratio of GNP, the U. S. ranks sixth in both 1975 and 1985. Third, however, it is difficult to interpret this fact since there is virtually no correlation between this ratio and GDP per capita in the sample countries. Fourth, considering public expenditure through the secondary level (K-12) as a ratio of GNP, U.S. ranks in the middle (9th in the group of 18) in both 1975 and 1985. Fifth, as for the ratio of total expenditure of GNP, it is difficult to interpret this fact in terms of "underspending" or "overspending" since the sample correlation between this ratio and GDP per capita is negative although statistically insignificant. Sixth, considering public expenditure per student at K-12 levels, the U. S. ranks second in 1975 and fourth in 1985. Seventh, unlike the expenditure-GNP ratio, expenditure per student does correlate strongly and positively with GDP per capita in the sample countries. Eighth, despite the aforesaid correlation, it does not appear useful to compare the ratio of expenditure per student to GDP per capita, and it seems more appropriate to estimate a simple expenditure-per-student function from the sample data and to compare the "predicted" value with that actually observed. Ninth, when such a comparison is made, it is noted that spending by the U.S. in 1975 almost exactly equals the predicted value, but that in 1985 is below the predicted value. Last, the conclusion appears to be that the data do not support the view that there is either substantial "underspending" or "overspending" in public educational outlays in the United States. There may recently have been some underspending at K-12 levels, but it deserves a much more careful look. Two overall lessons from the study are: (a) data should be handled with great care, and (b) there is need to move away from descriptive comparisons, and to focus on modeling of public educational expenditures so as to be able to compare the observed outlays with what may be treated as fair approximations to the "optimal" or "desirable" levels.

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I. INTRODUCTION

The level of public spending on education in the United States has recently been a matter of considerable controversy. For instance, Rasell and Mishel (1990) challenged statements by several federal officials who had claimed that public expenditure on education in the country was very high and was not an issue in discussions of educational quality. Rasell and Mishel did a thorough examination of educational expenditures in OECD countries, and concluded (1990, p. 10) "The claim that the U.S. spends more than other nations on education is misleading. By all comparisons, the U.S. devotes a smaller share of its resources to pre-primary, primary and secondary education than do most industrialized countries." The Rasell-Mishel work has, however, been criticized by several researchers. Besides the critique by the U.S. Department of Education (1990b), Perelman (1990) and Brimelow (1990) conclude almost the opposite. In one of his summarizing points, Perelman (1990, p. 2) states "U.S. spending on education, as a whole and on K-12, is virtually 'unsurpassed'; no major nation spends more per pupil--the only meaningful measure for such comparisons." Brimelow (1990, p. 84) similarly states "...the actual dollar amount it (the U.S.) spends on its pupils is about the highest in the world. Significantly, the U.S. is spending much more than Japan and Germany." Even for such a specific indicator as K-12 expenditure per student, the reports diverge considerably. For example, while Rasell and Mishel (1990, p. 15) show the U.S. to rank fourth or ninth, depending on which exchange rate is used, Perelman (1990, p. 3) shows the U.S. to rank second in essentially the same comparison group.

The main purpose of this study is not to settle the question concerning "underfunding" or "overfunding" of education in the U.S., but only to take a fresh look at the data, introduce some simple analytical considerations, and to make as fair a comparison as possible. In particular, the work is guided

by the following considerations:

1. Instead of focusing on one year, it seems better to take a slightly more extended historical look by considering data for two years that are separated by one decade. Therefore, the position for 1975 as well as 1985 is taken into account.

2. In view of the volatility of market exchange rates and their intrinsic drawbacks for intercountry comparisons of "real" magnitudes, much care is needed in converting expenditures into a common currency (dollar). Ideally one should base such conversions on relative-price levels for the relevant sector (education) in different countries. However, since such data are scarce, at least purchasing-power-parity (PPP) exchange rates for GDP should be used.

3. A descriptive cross-country comparison of either expenditure-GNP ratio or expenditure per student is not easy to interpret. It is not obvious, for example, whether a high-income country "should" have a higher or lower expenditure-GNP ratio. In other words, it is not evident what the "proper" elasticity of educational expenditure relative to GNP is. Similarly, it is not evident whether real expenditure per student "should" rise with GNP per capita, and, if so, by how much. Thus, questions concerning "underfunding" or "overfunding" are difficult to answer through simple descriptive comparisons. What one needs is some "model" of educational expenditure from which a fair approximation to the "optimal" or "desirable" number can be obtained so that the actual expenditure can be compared with that. Such an exercise is not easy, but is necessary for any reasonable answer to issues regarding overspending or underspending. This study makes a preliminary attempt to model expenditures, and to compare actual values with those "predicted" by regression estimates of the model from a sample of OECD countries.

II. COVERAGE, DATA, AND DATA SOURCES

Although any country-cluster can form the basis for such a study, this work is limited to the OECD countries. To some extent, such a choice is natural since these industrialized countries constitute a reasonable comparison group for the United States. Also, most of the recent debate on the subject rests on comparisons across the OECD countries. Excluding Greece, Portugal, Spain and Turkey, whose per capita incomes are considerably lower, and Iceland, which is very small, the "sample" consists of 18 countries.[1]

As already noted, the study focuses on the years 1975 and 1985. The latter is appropriate since most recent researchers focused on that, and detailed PPP exchange rates are also available for that year. Inclusion of 1975 enables a comparison of two points of time that are separated by one decade.

As in other studies, two basic measures of expenditure are considered. One is the ratio (or percentage) of educational expenditure to (aggregate) GNP. Although current educational expenditure might be a better measure of outlays during the year, since data on that are missing for some countries, the ratio used is based on total (current plus capital) expenditure. In view of the apparent lack of uniformity in classification of educational expenditures, taking the sum of current and capital outlays does not seem to be unsatisfactory.

The other measure studied is public educational expenditure per student. Although expenditure per student at any level can be considered, this study focuses on K-12 schooling (i.e., schooling from pre-elementary through secondary levels) because most of the disagreement appears to pertain to that level.

Cross-national comparisons of expenditure per student require that the

numbers in domestic currencies be converted into a common unit. A frequent practice for that purpose is to convert local currencies into U.S. dollars on the basis of market exchange rates. However, these exchange rates have been quite volatile in recent years, and exchange-rate fluctuations can mask even substantial "real" variations across countries. More important, these exchange rates are known to have serious weaknesses for cross-country comparisons of real magnitudes.[2] Therefore, one needs better measures of relative values of different currencies. Use of PPP exchange rates for GDP is only a partial solution because what one needs are measures based on relative prices of education in different countries. Nevertheless, since the latter measures are scarce, most calculations in this study are based on PPP exchange rates for GDP (for the relevant year), but a limited use has been made of PPP exchange rates for "education" (and "government") compiled by OECD (1987, pp. 24-25) for countries other than Switzerland.

Most data on ratio of educational expenditure to GNP are taken from UNESCO's Statistical Yearbook for 1989. However, to ensure that, as far as possible, all data pertain to 1975 and 1985, some other volumes of the Yearbook have also been used. Almost all information on enrollments is also taken from UNESCO (1989). PPP exchange rates for GDP are taken from OECD (1989) which is also the source for indices of real GDP per capita. These indices are based on PPP exchange rates and are different from measures of GNP or GDP per capita derived from market exchange rates. As already stated, PPP exchange rates for education and government, which are known only for 1985, are taken from OECD (1987). Some limited information on enrollment in vocational institutions and on duration (in years) of various levels of schooling in different countries comes largely from UNESCO (1989). Appendix I states the data sources in greater detail.

Some of the data deficiencies may be noted:

1. In addition to the fact that ratio of educational expenditure to GNP is based on the sum of current and capital expenditure, the ratio for K-12 expenditure is derived from the ratio of total expenditure to GNP by using the distribution of current public outlays across different levels. Also, data for Denmark pertain to 1986 since complete information for 1985 is not available.[3]

2. Calculation of K-12 expenditure per student is subject to several qualifications. First, as is well known, the numbers typically show public expenditure for students in both public and private institutions. Second, although current public expenditures are apparently reported for most countries, footnotes to UNESCO (1989) Tables indicate that the information for Japan and U.S.A. probably includes both public and private expenditures. Although some data on public expenditures are reported in other sources, their accuracy is uncertain; they seem to be based on public expenditure in public institutions and apparently exclude public expenditure directed toward students in private institutions. Third, information for U.S.A. appears to include both current and capital expenditure.[4] Fourth, information for Denmark covers 1986 instead of 1985. Fifth, Swiss enrollment for pre-primary level is for 1976 instead of 1975 (although the more important numbers for other levels pertain to 1975). Last, 1975 expenditure-by-level data for Australia and the corresponding 1985 data for Italy are missing.

III. COMPARISONS OF EXPENDITURE-GNP RATIOS

Table 1 contains the basic information. It is evident that when the ratio of total educational expenditures to GNP is considered, the U.S. ranks sixth in both 1975 and 1985. However, since data for the U.S. (and for

Japan), at least for 1985, include private expenditures also, the comparison may be somewhat inaccurate.[5] If private expenditure is excluded, the U.S. would rank lower at least in 1985, but the actual rank remains uncertain since accurate information is lacking.[6] If percentages reported by the U.S. Department of Education (1990a, p. 388) are taken as correct, the U.S. rank would remain largely unchanged for 1975 but would fall from sixth to thirteenth in 1985.[7]

If the ratio of K-12 expenditure to GNP is considered, the U.S. rank is around ninth in both 1975 and 1985. The possible inclusion of some private outlays in this case is not a serious problem since private expenditures at K-12 levels are relatively small.[8]

The ranks in Table 1 are different from those reported by Rasell and Mishel (1990, p. 11). In particular, they rank the U.S. higher on the ratio of total expenditure to GNP but assign it a lower rank on the ratio of K-12 expenditure to GNP. Appendix II contains some observations on the differences which are not easy to reconcile.[9]

The broad position, however, at least for K-12 expenditure, is the same whether one looks at Table 1 or at the Rasell-Mishel (1990, p. 11) data. Irrespective of the exact rank, it cannot be said that the U.S. ranks "high" in the OECD group.

The implications of such a fact may merit some reflection. Much of the discussion by Rasell and Mishel (1990) seems to assume that a higher rank is better. At least at a general level, that is not so. Taking an extreme case, it seems reasonable to say that a country which spends all its income on schooling is not doing "better" than one that spends 90% of its income on education, irrespective of their income levels. It is perhaps obvious that there is some "optimal" level of educational "effort", and "overspending" or

"underspending" can be properly judged only with reference to such an optimum.

While good models of national educational effort are scarce, much of the argument suggesting that K-12 expenditure ratio for the U.S. is not high enough seems to rest on the premise that one expects a higher ratio from a country with higher income. In other words, the implicit model postulates the ratio to rise with income (GDP) per capita. Even though theoretical basis for such a model is not evident, an empirical assessment of its validity is relatively straightforward. One simple approach would be look at the correlation between GDP per capita and ratio of educational expenditure to GNP in the relevant cross-country sample. Table 2 reports the sample correlations for 1975 and 1985. The numbers are shown for the ratio of total as well as K-12 expenditure to GNP. It is obvious that that the correlations are low and statistically insignificant at any acceptable level. Moreover, while correlations for the total expenditure ratio are positive (although statistically insignificant), those for K-12 expenditure are negative and numerically larger (although still not significant at the 10% level). Simple regressions of the ratios on indices of GDP per capita reveal the same position.[10] Therefore, one cannot use the per-capita income criterion to determine whether the U.S. "overspends" or "underspends" on education in terms of expenditure-GNP ratios.

The proposition that the ratio of educational expenditure to GNP bears no significant relation with GDP (or GNP) per capita in cross-country samples is not a statistical "coincidence" observed in the samples used in this study. In a much broader international context, Zymelman (1976, p. 3), who did a thorough study of patterns of educational expenditures for 1973, stated "...the portion of the GNP a nation dedicates to education, and the way the budget is allocated among the different levels of education is not a function

of GNP per capita..." He estimated several models of expenditure-GNP ratios for various levels of education, and concluded that the major factors affecting these ratios were (a) "cost" expressed as the ratio of expenditure per student to GNP per capita, (b) enrollment ratio, and (c) "demographic burden" defined as the ratio of relevant school-age population to the total population.[11] Although he did not report regression estimates for the OECD group, his tabulations (1976, pp. 77-80) show that expenditure-GNP ratio for the U.S. at the elementary level was slightly above the "typical" OECD country, that for the secondary level (and the one for all levels) was well above the typical case, and that for post-secondary education was much above the typical country ratio.[12]

Two conclusions are suggested by the foregoing discussion. First, available data are good enough only for broad assessments, and are not suitable for making fine comparisons or determining exact ranks. More important, when the broad picture is considered, while it can be fairly stated that the U.S. does not rank high among the OECD countries, at least in terms of the ratio of K-12 expenditure to GNP, it cannot be reasonably inferred from such a comparison alone whether there is underspending or overspending on K-12 education in the United States.[13] The belief that seems to underlie some studies on the subject, namely, that a higher-income country is expected to have a larger ratio of educational expenditure to GNP, is not supported either by any clear theoretical consideration or by data from the OECD countries or broader cross-country samples.[14]

IV. COMPARISONS OF K-12 EXPENDITURE PER STUDENT

Although expenditure per student can be considered for any level, since the controversy appears to center on K-12, that is the level studied in this work.

Table 3 contains the basic information for 1975 and 1985. As explained in Appendix I, almost all data on enrollments and expenditures are taken from UNESCO's Statistical Yearbook for 1989, and conversion into dollars is done on the basis of PPP exchange rates for GDP compiled by OECD (1989, p. 151) for the relevant year.

It is obvious from Table 3 that the U.S. ranks very high (second) in 1975 and fairly high (fourth) in 1985. Also, difference between the 1985 numbers for U.S.A., Sweden and Canada is quite small. Therefore, the U.S. can be considered as virtually ranking second or third in 1985.

The estimates given in Table 3 for 1985 differ from those reported by Rasell and Mishel (1990, p. 15) and Perelman (1990, p. 3). Departures from Rasell-Mishel estimates are understandable since they used market exchange rates, and variations from Perelman's Table are minor in most cases.[15] Despite the observed differences, the broad position is fairly similar in the three studies.

Based on estimates of the foregoing kind, Perelman (1990, p. 2) concluded "U.S. spending...(on K-12) is virtually 'unsurpassed'; no major nation spends more per pupil."

Rasell and Mishel, however, constructed another measure by taking K-12 expenditure per student as a ratio of per capita income, and showed the U.S. to rank near the bottom in their sample of 16 OECD countries.

Since Rasell and Mishel used market exchange rates for converting expenditures into U.S. dollars, their uneasiness with the resultant numbers is somewhat understandable because, to use their own words, "(of) instability of exchange rates" and "countries with higher income (have) higher wages". However, an appropriate remedy for these problems is to use better conversion measures, and the logic of comparing the ratio of expenditure per student to

per capita income is not entirely clear; use of PPP exchange rates seems to be a step in the proper direction.[16]

Like the expenditure-GNP ratios, interpretation of country ranks on expenditure per student is not easy. As illustrated through an extreme case of expenditure-GNP ratio, it is not necessarily true that a higher expenditure per student, or a higher cross-country rank on that measure, is better. There is presumably an optimal level relative to which one may identify cases of overspending or underspending. The Rasell-Mishel procedure is apparently based on a somewhat special implicit model: that the ratio of expenditure per student to income per capita should be either constant or should rise with income. In other words, the model postulates that elasticity of expenditure per student with respect to income per capita is not smaller than unity (1).

Instead of imposing a prior restriction on the relation between expenditure per student and income per capita, it seems better to specify a less restrictive expenditure function and to obtain its parameter estimates from the sample information. Not merely is then the model made explicit, but one can also obtain "predicted" or "expected" values for expenditure and compare these with the actual numbers.

At the simplest level, a specification for K-12 expenditure per student can be formulated in terms of GDP per capita. Unlike the case of expenditure-GNP ratio, such a model is not likely to be unsuccessful since, even after the use of PPP exchange rates, there is high positive correlation between K-12 expenditure per student and GDP per capita.[17] The following specification seems to be a reasonable candidate for the purpose

$$\text{Log}(E)_{ij} = a + b \log(RY)_{ij} + u_{ij} \qquad (1)$$

where E_{ij} denotes K-12 dollar expenditure per student in country i for year j,

RY_{ij} stands for GDP per capita of that country in that year, "log" represents (natural) logarithm of the variable, and u is the random stochastic term with the nice properties assumed in standard regression models. Logarithmic specification appears better than a linear model because of its constant-elasticity property. Also, Zymelman's (1976) study indicates that log-log regressions did better than linear models for "costs".[18]

Equation (1) has been estimated by the least-squares procedure for 1975 and 1985 separately, and predicted values and "residuals" have been obtained on the basis of the estimated regression parameters. The model shows high explanatory power for both years, and adjusted R^2s are of the order of 0.60 to 0.65. Table 4 contains the actual and predicted values and the residuals for each countr.[19]

It is clear that K-12 expenditure per student in the U.S. in 1975 almost exactly equals the predicted value. Therefore, if the foregoing model is considered reasonable, U.S. expenditure level in 1975 was very close to the optimal number; countries like Denmark were substantial "overspenders", and New Zealand, France and Italy were major "underspenders".

The position for 1985 is somewhat different. The U.S. expenditure is smaller than the predicted value by about 12% which can be considered as substantial. The major overspenders in this case are Sweden, Switzerland, Denmark and Austria, and other major underspenders are New Zealand, Germany and Japan.[20] One can thus say there is evidence of some underspending by the U.S., although (if that is any consolation) underspending by Japan and Germany is even bigger.[21]

Even though this simple model does extremely well in terms of explanatory power, several obvious caveats are appropriate in the interpretation of such regression results. Apart from the small sample size and some other possible

econometric problems, it is evident that the predicted values depend on sample coverage, year studied and the specification used, and much caution is needed in using the results.[22] It is obviously possible to augment the model in several ways, to study some other recent year(s), and to work with slightly different sample coverages even within the OECD group. There is considerable scope for work in these directions.

It does seem, however, that the broad position is fairly robust to several alterations in the model. In terms of explanatory power, as judged by adjusted R^2s, there does not seem to be any obvious scope for doing significantly better. Appendix III contains a summary of adjusted R^2s for ten different regressions that include some richer specifications also. The simple model of equation (1) outperforms almost all of them.[23]

Since some richer models seem to do marginally better in terms of explanatory power, it may be of interest to compare the pattern of residuals for those models with that based on equation (1). Table 5 provides a flavor of the comparative position. It can be seen that U.S. underspending declines from about 12% to around 10% if "model 2" of Table 5 is used instead of equation (1), and can even be reduced further to about 5% if "model 3" were used. Both model 2 and model 3 are reasonable extensions of equation (1). In the former, we add variables representing (a) the proportion of K-12 enrollment that is in "vocational" institutions, and (b) (logarithm of) years of schooling covered by elementary and secondary levels in different countries.[24] Both variables may be expected to affect expenditure per student. Similarly, model 3, which consists of adding a "relative price" term in equation (1), seems reasonable. However, it is difficult to be enthusiastic about these extensions because no variable other than income (RY) shows statistical significance even at the 10% level in the extended models. Moreover, data on

enrollment in vocational institutions seem weaker than those on total enrollment, and computation of the index of "relative price" for education in various countries appears to be still experimental. Also, use of model 3 necessitates exclusion of Switzerland since sectoral PPPs for that country are not available even for 1985. It is possible that the regression parameter estimates, and the pattern of predicted values and residuals, would change significantly if Switzerland is included. Much caution is, therefore, needed in interpreting the results of model 2 and model 3 in Table 5, and in undertaking extensions of equation (1) to increase or reduce a particular residual. Nevertheless, there is obviously scope for additional work in regard to model specification and model choice.[25]

Last, it should be noted that the preceding discussion implicitly treats expenditure per student as a measure of "quality" or "effort", and, in that perspective, one would not want to be short of (or in excess of) the "optimal" level. If expenditure is treated as an indicator of "cost" or "price" or is related to "productivity", it might even be possible to view a "low" value as something desirable.[26] On the other hand, however, predicted values of expenditure from the estimated regressions are not "optimal" in any strong sense. These are just "expected" numbers on the basis of the observed relation between expenditure and GDP per capita in the sample countries, and one could argue that the public educational "effort", as represented by expenditure per student, "should" not depend so heavily on GDP per capita of the country.[27]

V. CONCLUDING REMARKS

Apart from providing a comparative picture for 1975 and 1985, using consistent data to the extent possible, and relying primarily on PPP exchange

rates for conversion of local currency expenditure data into dollar measures, the two main points made in this study are (a) available cross-country data on educational expenditure are not good enough for fine comparisons, and (b) even for obtaining a broad indication, descriptive comparisons of country ranks do not seem to constitute an appropriate basis for drawing inferences on "adequacy" of funding in the United States or any other country. For such inferences, one needs models of educational expenditure that can yield some indication of the optimal level with which the actual can be compared. Using OECD cross-country data for 1975 and 1985, it is shown that GDP per capita cannot be usefully employed as an explanatory variable in models of expenditure-GNP ratio since the two variables show no significant correlation in the samples studied or in broader international samples. A simple model of K-12 expenditure per student is, however, proposed in terms of GDP per capita, and its estimation from the OECD data shows the model to have high explanatory power. Comparison of actual expenditures with those predicted by the estimated parameters suggests that while K-12 expenditure per student in the United States was quite close to the "optimal" level in 1975, that in 1985 indicates underspending of the order of 10% to 12%.[28] The many problems pointed out in this study give an indication of the scope for further work in terms of exploration of different models, greater reliance on PPP exchange rates for education, more extended intertemporal and cross-country comparisons, and a continuous monitoring of the position at least across the OECD group.

TABLE 1

Comparison of the Ratio of Educational Expenditure to GNP:
Selected OECD Countries, 1975 and 1985
(arranged in the declining order of numbers which are percentages)[a]

1975				1985			
All levels		K-12 only		All levels		K-12 only	
1. Netherlands	8.2	1. Denmark	5.5	1. Sweden	7.8	1. Ireland	5.5
2. Denmark	7.8	2. Norway	5.2	2. Denmark	7.5	2. Sweden	5.3
3. Canada	7.6	3. Netherlands	5.1	3. Canada	7.0	3. Denmark	4.7
4. Norway	7.1	4. Finland	4.9	4. Ireland	6.9	4. Norway	4.7
5. Sweden	7.0	5. Canada	4.8	5. Netherlands	6.8	5. Canada	4.5
6. U.S.A.	6.8	6. Belgium	4.5	6. U.S.A.	6.7	6. Belgium	4.3
7. U.K.	6.6	7. U.K.	4.5	7. Norway	6.4	7. Finland	4.1
8. Australia	6.5	8. Ireland	4.4	8. Belgium	6.0	8. France	4.1
9. Finland	6.3	9. U.S.A.	4.3	9. Australia	5.9	9. U.S.A.	4.1
10. Belgium	6.2	10. Austria	4.3	10. Austria	5.8	9. Austria	4.1
11. New Zealand	6.1	11. Japan	4.3	10. France	5.8	11. Netherlands	4.0
11. Ireland	6.1	12. Switzerland	4.1	12. Finland	5.7	12. Switzerland	3.7
13. Austria	5.7	13. New Zealand	3.7	13. Japan	5.1	13. Australia	3.7
14. Japan	5.5	14. Germany-FRG	3.6	14. U.K.	4.9	14. U.K.	3.6
15. France	5.2	15. France	3.6	14. New Zealand	4.9	15. New Zealand	3.3
16. Switzerland	5.1	16. Sweden	3.6	16. Switzerland	4.8	16. Japan	3.2
16. Germany-FRG	5.1	17. Italy	3.0	17. Germany-FRG	4.5	17. Germany-FRG	3.0
18. Italy	3.9	18. Australia	.[b]	18. Italy	4.0	18. Italy	.[b]

[a]It might seem that the number of tied ranks is more than what the Table shows. However, the stated ranks are actually correct when K-12 expenditure calculations are carried to two decimal places.

[b]Data are not available.

TABLE 2

Sample Correlations Between the Ratio of Educational Expenditures to GNP and Index of Real GDP Per Capita: Selected OECD Countries, 1975 and 1985[a]

	1975	1985
Expenditure at all levels	0.26 (N=18)	0.17 (N=18)
K-12 expenditure	-0.37 (N=17)	-0.38 (N=17)

[a]Expenditure-GNP ratios are taken from Table 1, and indices of real GDP per capita, with OECD=100, are taken from OECD (1989, p. 145).

TABLE 3

K-12 Expenditure Per Student in Selected OECD Countries: 1975 and 1985, current U.S. dollars based on PPP exchange rates (arranged in the decreasing order of expenditure)

----------1975[a]----------		----------1985[b]----------	
1. Switzerland	1,507	1. Switzerland	3,683
2. U.S.A.	1,466	2. Sweden	3,215
3. Denmark	1,408	3. Canada	3,192
4. Canada	1,190	4. U.S.A.	3,177
5. Norway	1,168	5. Denmark	3,075
6. Sweden	1,143	6. Norway	2,899
7. Finland	1,007	7. Austria	2,497
8. U.K.	1,005	8. Finland	2,394
9. Netherlands	957	9. U.K.	2,251
10. Belgium	931	10. Belgium	2,234
11. Austria	821	11. France	2,032
12. Germany-FRG	803	12. Australia	1,983
13. France	727	13. Netherlands	1,956
14. Japan	706	14. Germany-FRG	1,864
15. Italy	603	15. Japan	1,805
16. New Zealand	568	16. New Zealand	1,231
17. Ireland	446	17. Ireland	1,161

[a]Data for Australia are not available.

[b]Data for Italy are not available.

TABLE 4

Comparison of Actual and "Predicted" Values of K-12 Expenditure Per Student in Selected OECD Countries, 1975 and 1985

[Arranged in the decreasing order of the "residual" defined as excess of the actual over the predicted value based on regression equation (1)][a]

1975	ACTUAL	PREDICTED	RESIDUAL
1. Denmark	1,408	929	479
2. Norway	1,168	929	239
3. Finland	1,007	827	180
4. Switzerland	1,507	1,338	169
5. U.K.	1,005	877	128
6. Belgium	931	839	92
7. Austria	821	777	44
8. Sweden	1,143	1,115	28
9. Ireland	446	431	15
10. U.S.A.	1,466	1,468	-2
11. Netherlands	957	981	-24
12. Japan	706	752	-46
13. Canada	1,190	1,281	-91
14. Germany-FRG	803	916	-113
15. Italy	603	789	-186
16. France	727	942	-215
17. New Zealand	568	929	-361

1985	ACTUAL	PREDICTED	RESIDUAL
1. Sweden	3,215	2,482	733
2. Switzerland	3,683	3,002	681
3. Denmark	3,075	2,414	661
4. Austria	2,497	1,990	507
5. Belgium	2,234	1,990	244
6. Finland	2,394	2,183	211
7. U.K.	2,251	2,054	197
8. Ireland	1,161	1,080	81
9. Norway	2,899	2,860	39
10. Canada	3,192	3,290	-98
11. Netherlands	1,956	2,151	-195
12. Australia	1,983	2,183	-200
13. France	2,032	2,249	-217
14. U.S.A.	3,177	3,624	-447
15. Japan	1,805	2,281	-477
16. Germany-FRG	1,864	2,348	-484
17. New Zealand	1,231	1,833	-602

[a] 1975 data for Australia and 1985 data for Italy are not available, and these countries are, therefore, not included in the relevant year.

The regression estimates (with t-statistics in parenthesis) are given below:

1975 $\quad \text{Log}(E) = \underset{(0.51)}{0.637} + \underset{(5.00)}{1.354}\ \log(RY) \qquad \bar{R}^2 : 0.60$

1985 $\quad \text{Log}(E) = \underset{(1.22)}{1.400} + \underset{(5.51)}{1.387}\ \log(RY) \qquad \bar{R}^2 : 0.65$

See also note 22 regarding the position if Ireland is excluded from the sample.

TABLE 5

Comparison of Residuals from Different Models of K-12 Expenditure Per Student in Selected OECD Countries, 1985
[Arranged in decreasing order of the residuals][a]

Model 1[b]	ACT.	PRED.	RES.	Model 2[b]	ACT.	PRED.	RES.	Model 3[b]	ACT.	PRED.	RES.
1. Sweden	3,215	2,482	733	1. Switzerland	3,683	2,694	989	1. Denmark	3,075	2,247	828
2. Switzerland	3,683	3,002	681	2. Sweden	3,215	2,669	545	2. Sweden	3,215	2,473	741
3. Denmark	3,075	2,414	661	3. Denmark	3,075	2,632	443	3. Austria	2,497	2,132	365
4. Austria	2,497	1,990	507	4. U.K.	2,251	1,813	438	4. Finland	2,394	2,144	250
5. Belgium	2,234	1,990	244	5. Austria	2,497	2,092	405	5. Norway	2,899	2,715	184
6. Finland	2,394	2,183	211	6. Finland	2,394	2,283	111	6. Belgium	2,234	2,072	162
7. U.K.	2,251	2,054	197	7. Ireland	1,161	1,082	79	7. U.K.	2,251	2,099	152
8. Ireland	1,161	1,080	81	8. Belgium	2,234	2,185	49	8. Ireland	1,161	1,120	41
9. Norway	2,899	2,860	39	9. Canada	3,192	3,176	16	9. Canada	3,192	3,185	7
10. Canada	3,192	3,290	-98	10. Netherlands	1,956	2,040	-84	10. Australia	1,983	2,134	-151
11. Netherlands	1,956	2,151	-195	11. Norway	2,899	3,058	-159	11. U.S.A.	3,177	3,347	-170
12. Australia	1,983	2,183	-200	12. Australia	1,983	2,254	-271	12. New Zealand	1,231	1,437	-206
13. France	2,032	2,249	-217	13. France	2,032	2,321	-289	13. France	2,032	2,321	-289
14. U.S.A.	3,177	3,624	-447	14. New Zealand	1,231	1,551	-320	14. Netherlands	1,956	2,247	-291
15. Japan	1,805	2,281	-477	15. U.S.A.	3,177	3,523	-345	15. Germany-FRG	1,864	2,431	-567
16. Germany-FRG	1,864	2,348	-484	16. Japan	1,805	2,254	-449	16. Japan	1,805	2,379	-574
17. New Zealand	1,231	1,833	-602	17. Germany-FRG	1,864	2,465	-601				

[a] 1985 data for Italy are not available, and the country is not included in this Table. Data on relative price of education for Switzerland are not available, and this country could not be included in Model 3.

[b] The three models are given below:

Model 1: Equation (1) of the text [$\text{Log}(E) = a1 + b1 \log(RY)$]

Model 2: $\text{Log}(E) = a2 + b2 \log(RY) + c2\ VRATIO + d2 \log(YEARS)$, where VRATIO is the ratio of enrollment in vocational institutions to total K-12 enrollment, and YEARS stands for number of years of schooling in the elementary and secondary cycles.

Model 3: $\text{Log}(E) = a3 + b3 \log(RY) + c3 \log(RPE)$, where RPE is "relative price" of education and is defined as the ratio of the PPP exchange rate for education to the PPP exchange rate for GDP.

NOTES

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1. Ireland's per capita income is also lower, and is in fact lower than that of Spain. However, Ireland is included here because of its inclusion in the countries studied by Rasell and Mishel (1990). Note 22 is relevant in this context. It may also be noted that Iceland and Yugoslavia are not included because the former is small and the latter really does not belong in the group. Moreover, real GDP per capita and PPP exchange rates for these two countries are not reported in OECD (1989).
2. A good discussion of these weaknesses is provided by Kravis, Heston and Summers (1982).
3. As an aside, comparison of the available numbers for 1985 and 1986 suggests a big increase in the expenditure in 1986. For example, the percentage of total expenditure to GNP was 6.4 for 1985 [UNESCO (1988, p. 4-16)] and 7.5 for 1986 [UNESCO (1989, p. 4-17)].
4. As a general point, note that academic-year or fiscal-year expenditures are typically reported by UNESCO as pertaining to calendar years. This practice causes an obvious overlap in some cases, but preliminary calculations for U.S.A. do not indicate it to be an important aspect. As notes to Tables in the Statistical Yearbook show, the data reported by UNESCO have several other weaknesses also. However, most of these seem unimportant for the purpose of this study.

5. Of course, it is possible to argue that the national "effort" is indicated by the ratio of total (public plus private) expenditures to GNP, and one should not exclude private expenditures. In that case, ranks shown in Table 1 will be fairly accurate since private expenditures in most other countries (except Japan and U.S.A.) are relatively small.

6. Rasell and Mishel (1990, p. 14) do indicate the breakup between private and public expenditures in 1985 for U.S.A. and Japan. However, the basis for their calculations is not entirely clear. For the U.S., they show the public percentage as 5.0 for all levels and 3.8 for K-12. Digest of Education Statistics 1989 (p. 388) shows public expenditure at all levels to be 5.5% of GNP, which is the number one would probably get by taking public expenditure in public institutions. Therefore, even 5.5 seems to be an underestimate since public expenditure directed to private institutions should also be included. This is just one example of the difficulty of making fine comparisons without a much closer look at the published numbers.

7. Accuracy of the Department of Education numbers is uncertain because these appear to reflect public expenditure for public institutions only. Moreover, while UNESCO (1989, p. 4-11) reports the number for 1975 as 6.8 (%) and says (p. 4-21) that it refers to total public and private expenditure, Digest of Education Statistics 1989 (p. 29) shows the total expenditure as 7.4% of GNP in 1975.

8. Table 1 shows 1985 percentage for the U.S. as 4.1, which can be treated as fairly accurate. Even calculations by Rasell and Mishel (1990, p. 14) indicate the public part as 3.8%, although apparently they did not include public expenditure for private K-12 institutions. Also, U.S. data seem to exclude the pre-elementary level.

9. As an interesting aside, U.S. Department of Education data on ratio of public expenditure to GNP, given on page 388 of Digest of Education Statistics 1989, would make the U.S. rank lower on the ratio of total expenditure to GNP than on the ratio of K-12 expenditure on GNP.

10. Detailed regression results are available from the author.

11. The "adjustments" made by Rasell and Mishel to K-12 expenditure ratios on the basis of enrollment rates apparently follow a logic of the kind suggested by Zymelman's (1976) work. However, since the adjustments are made for only one of the three factors, a more explicit discussion of the rationale for the adjustments seems appropriate.

12. Note that he treats expenditure per student (as a ratio of GNP per capita) as a measure of "costs".

13. The entire discussion in the text is based on expenditure-GNP ratios expressed in local currencies. A preliminary effort was also made to "refine" these ratios for 1985 by adjusting for the difference between PPP exchange rates for "education" (or "government") sector and for GDP. Those results are not discussed because, apart from the information for Switzerland not being available, they seem to provide little additional insight. This is another area that seems worthy of further exploration.

14. The position may not be the same in intracountry (intertemporal) data, at least for some countries. However, in that case, a cross-country comparison is not quite appropriate. Note also the theoretical reasoning suggested by Perelman (1990, pp. 5-6) against treating a high expenditure-GNP ratio as a valid measure of stronger national educational effort.

15. Variations from Perelman's chart are sizeable for U.S.A. (his 3,310 versus 3,177 in Table 3) and Germany (his 2,253 versus 1,864). The numbers reported in Table 3 seem to be accurate on the basis of UNESCO data which

have been used for all countries (including the U.S.) for the sake of consistency.

16. They state (1990, p. 28) "Purchasing power parity rates could be used for the conversions, but they also give misleading results." The logic underlying this statement is not clear.

17. The correlation coefficient is 0.75 for both 1975 and 1985, and carries high statistical significance.

18. The specificational aspect is discussed briefly later in the text. See also Appendix III. It is obvious that variables like teacher salaries and student-teacher ratio also belong in these models. However, it is difficult to get useable data on these variables, especially since the expenditure variable covers a long educational period of more than 12 years.

19. As an aside, the pattern of residuals is quite "symmetric" for both years. Also, there is little correlation between the residuals and GDP per capita.

20. Interestingly, at least for 1985, "overspenders" like Sweden and Switzerland have very large public sectors and may be considered as less "market oriented", while Germany, Japan and U.S.A., who are major underspenders, could be deemed to have a stronger market orientation.

21. It is interesting to note that the U.S. rank in terms of regression residuals for 1985 almost exactly equals that in terms of the ratio of expenditure per student to income per capita, as depicted by Rasell and Mishel (1990, p. 19), but the conclusions are different in the two cases.

22. Since Ireland may seem to be an "outlier" in the sample in terms of GDP per capita, it should be useful to note that the results are fairly robust to the exclusion or inclusion of Ireland. For example, if Ireland is excluded, predicted K-12 expenditure per student for the U.S. would be

$1,494 and $3,766 for 1975 and 1985 respectively. The position suggested by these numbers is similar to that indicated in Table 4, which is not surprising since Ireland is really not an outlier in terms of the regression structure. Additional regression details are available from the author.

23. Full regression results for other models are available on request.

24. Since VRATIO is zero for some countries, its logarithmic transformation is difficult.

25. In a somewhat different "production function" framework, Schultz (1988) provides a modelling of cross-country schooling expenditures.

26. This is apparently the spirit in which Zymelman (1976) treated expenditure per student and Perelman (1990, p. 2) views such measures. The survey by Hanushek (1986) on production and efficiency in public schools in the U.S. is also relevant here.

27. This is the kind of argument that has been given in recent legal challenges to school finance systems in several U.S. states. However, such a reasoning becomes much more difficult in a cross-country context, and leads to extremely complex issues relating to international "equity".

28. In a different and much more sophisticated framework involving dynamic optimization (and economic growth), Lucas (1988, p. 26) stated"...the U.S. economy 'ought' to devote nearly three times as much effort to human capital accumulations as it does, and 'ought' to enjoy growth in per-capita consumption about two full percentage points higher than it has had in the past." Of course, care is needed in interpreting Lucas's statement. It refers to "human capital", and not merely to schooling. Also, it is based on a certain model of growth, and the inference depends not only on the model specified but also on the estimated (and assumed) parameter values.

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APPENDIX I
Data Sources

1. RATIO OF EDUCATIONAL EXPENDITURE TO GNP: For both 1975 and 1985, data are taken from UNESCO (1989, pp. 4-10 to 4-20). As noted in the text, the number for Denmark pertains to 1986 and not 1985.

2. PUBLIC CURRENT EXPENDITURE BY LEVEL for 1975 and 1985 is taken from Table 4.3 of UNESCO (1989) with the following exceptions:

a. Since Danish data for 1985 are not available, those for 1986 are used.

b. 1985 data for Belgium, Canada and Sweden are from UNESCO Statistical Yearbook for 1987.

c. 1985 data for Austria, New Zealand and Switzerland are from UNESCO Statistical Yearbook for 1988.

3. STUDENT ENROLLMENTS for 1975 and 1985 are from Tables 3.3, 3.4, 3.7 and 3.8 of UNESCO Statistical Yearbook for 1989 with the following exceptions:

a. Danish data are for 1986.

b. Data for Sweden for 1985 are from UNESCO Statistical Yearbook for 1988.

c. Swiss enrollment at pre-elementary level is for 1976 instead of 1975, and enrollment at level 1 (elementary) for 1975 is taken from UNESCO Statistical Yearbook for 1988.

4. PPP EXCHANGE RATES for GDP for 1975 and 1985 are taken from OECD (1989, p. 151) for all countries including Switzerland. The rate for Denmark is for 1986 since expenditure data are for that year.

5. SECTORAL PPP EXCHANGE RATES for "education" and "collective consumption by government" are from OECD (1987, pp. 24-25).

6. INDICES OF REAL GDP PER CAPITA (with OECD = 100) are taken from OECD (1989, p. 145). Note that these are based on PPP exchange rates.

7. ENROLLMENT IN VOCATIONAL INSTITUTIONS is taken from the same sources as those used for second-level enrollments described in paragraph 3.

8. DURATION (IN YEARS) of elementary and secondary levels is taken from Table 3.1 of UNESCO Statistical Yearbook for 1989 (pp. 3-7 to 3-12).

APPENDIX II

SOME OBSERVATIONS ON TABLE 1 OF RASELL AND MISHEL (1990, p. 11)

1. These comments are limited to the numbers shown as total and K-12 expenditures as percentages of GDP. No comments are made on the adjusted ratios.

2. As a preliminary observation, the authors give data for 1983 and 1984 for five countries while using 1985 information for the other eleven. This makes a direct comparison difficult.

3. The cited data sources (UNESCO's Statistical Yearbook 1988 and Digest of Education Statistics 1988) do not seem to have the numbers shown in their Table 1. The following is an illustrative comparison in respect of total (K-12 plus post-secondary) expenditure:

	percentage reported by Rasell and Mishel	percentage given in the source
U.S.A.	6.8	6.7 (Digest 1988, p. 29)
Australia	5.5	5.6 (Statistical Yearbook 1988, p. 4-19)
Canada	6.8	7.0 (Statistical Yearbook 1988, p. 4-9)
Denmark	6.0	6.4 (Statistical Yearbook 1988, p. 4-16)
France (1984)	5.9	6.1 (Statistical Yearbook 1988, p. 4-16)
Ireland (1984)	6.0	6.7 (Statistical Yearbook 1988, p. 4-17)
Japan	6.5	5.1 (Statistical Yearbook 1988, p. 4-14)
Netherlands (1984)	6.8	6.9 (Statistical Yearbook 1988, p. 4-18)
Norway	6.3	6.5 (Statistical Yearbook 1988, p. 4-18)
Sweden	7.6	7.7 (Statistical Yearbook 1988, p. 4-18)
Switzerland	5.1	4.8 (Statistical Yearbook 1988, p. 4-18)

4. 1985 information for Ireland and Italy is given in the source (Statistical Yearbook 1988, p. 4-17). The reason for taking 1984 and 1983 is not clear.

5. Rasell and Mishel report the percentages relative to GDP, but the sources give these relative to GNP.

6. The UNESCO Yearbooks do not directly give information on the ratio of K-12 expenditure to GNP (or GDP). The procedure used for obtaining these numbers is not known.

APPENDIX III

COMPARISON OF SEVERAL MODELS OF K-12 EXPENDITURE PER STUDENT IN SELECTED OECD COUNTRIES IN TERMS OF THE CRITERION OF ADJUSTED R^2

		1975 ($\bar{R}^2$)	1985 ($\bar{R}^2$)
1.	Equation (1) of the text	0.60	0.65
2.	Regression with expenditure and GDP per capita in linear terms	0.60	0.62
3.	Regression with linear expenditure and linear and quadratic income terms	0.57	0.60
4.	Equation (1) plus a quadratic log-income term	0.57	0.62
5.	Expenditure in linear form and income in logs	0.56	0.61
6.	Equation (1) plus VRATIO	0.57	0.64
7.	Equation (1) plus VRATIO plus logarithm of years of duration of levels 1 and 2	0.61	0.66
8.	Equation (1) plus logarithm of "price" of education[a]	.	0.61
9.	Equation (1) plus logarithm of "relative price" of education[a]	.	0.66
10.	Expenditure, income, and relative-price terms all in linear form[a]	.	0.59

[a] "Price" of education is defined as the PPP exchange rate for "education". "Relative price" of education is defined as the ratio of PPP exchange rate for education to the PPP exchange rate for GDP. These numbers are available only for 1985 and do not include Switzerland.